

**AMENDMENTS TO THE SPECIFICATION:**

Amend the specification as follows:

Page 1, after the title, insert the following centered heading:

**BACKGROUND OF THE INVENTION .**

Page 1, before paragraph 1, line 1, amend the heading as indicated below:

**1. TECHNICAL FIELD OF THE INVENTION:**

Page 1, paragraph 1, starting at line 2, has been amended as indicated below:

[[A]] The present invention relates to a process for producing a lead-acid battery and more particularly, a process for producing a lead-acid battery related to welding of terminal portions of the battery, and a jig for producing the same.

Page 1, after paragraph 1, line 6, the heading has been amended as indicated below:

**2. BACKGROUND DESCRIPTION OF THE RELATED ART:**

Page 1, paragraph starting at line 19, has been amended as indicated below:

In this case, at the time of welding using the burner, as mentioned above, in order to previously prevent [[that]] deformation of the lid ~~would be deformed due to a~~ as a result of welding heat, whereby an air-tightness failure would occur between the lid and the lead bushing integrally cast in the lid, it has preferably been practiced in general to carry out the burner welding in such a

state that an annular mold of a jacket type for passing cooling water therethrough is disposed in contact with ~~around~~ the peripheral surface of the lead bushing or the peripheral surface of the terminal mounted on the bushing.

Page 2, paragraph starting at line 7, has been amended as indicated below:

More particularly, in the case of producing the lead-acid battery of a bushing terminal type as described above, it has been conventional practice to weld terminal portions to be welded of the lead-acid battery, i.e., mutually abutted or adjacent peripheral portions of the lead bushing integrally cast in a lid made of a synthetic resin by an insertion molding and a pole of a battery body inserted through a cylindrical hole in the lead bushing to each other by a burner flame.

Page 2, paragraph starting at line 15, has been amended as indicated below:

In the case of welding of the pole and the lead bushing using the burner, however, if the height from the surface of the lid to an upper end surface of the lead bushing is not more than 8 ~ 10 mm, in other words, is less than 8 ~ 10 mm, ~~it is not avoidable that~~ deformation of the lid is deformed due to unavoidable as a result of the heat generated during the burner-welding, even if the above-mentioned cooling means is used, an air-tightness failure ~~is occurred~~ occurs between the lid and the lead bushing formed in the lid. Therefore, it is required that the upper end of the lead bushing protrudes more than 8 ~ 10 mm from the surface of the lid, and hence, such a corresponding height-wise space enough to accommodate the lead bushing terminal is required above the upper

surface of the lid. On the other hand, it is desirable to produce a lead-acid battery of the type leading out the terminal sideways which is capable of lowering a height-wise space above the upper surface of the lid. However, in the burner-welding of a base portion of the lead bushing and a plate-shaped terminal having a thickness of several mm, fitted thereon the distance between the portion of the terminal to be welded and the surface of the lid is only several mm, so that an air-tightness failure is often generated between the lid and the lead bushing cast in the lid due to the thermal deformation of the lid caused by the burner-welding, to result in many manufacture losses.

Page 3, paragraph starting at line 11, has been amended as indicated below:

Therefore, it is desired to remove such inconveniences and develop a process ~~capable of~~ for producing a lead-acid battery, wherein welding of the required portions can be achieved smoothly without any manufacture loss.

Page 4, before paragraph 1, line 2, the heading has been amended as indicated below

~~DISCLOSURE~~ SUMMARY OF THE INVENTION:

Page 4, paragraph starting at line 3, has been amended as indicated below:

It is an object of the present invention to provide a process for producing a lead-acid battery which has removed the problems associated with the prior ~~[[arts]]~~ art, and the present invention is

~~characterized in that~~ includes a lead bushing integrally cast in a lid of an assembled lead-acid battery and a pole inserted through the lead bushing are welded together by a laser welding.

Page 4, paragraph starting at line 9, has been amended as indicated below:

Further, a process for producing a lead-acid battery according to the present invention, ~~is characterized in that~~ includes welding of a lead bushing integrally cast in a lid of an assembled lead-acid battery and a pole inserted through the lead bushing and welding of the lead bushing and a tab terminal member fitly mounted on in the lead bushing are carried by a laser welding.

Page 4, paragraph starting at line 15, has been amended as indicated below:

Further, in the process for producing the lead-acid battery according to the present invention, ~~it is characterized in that~~ at the time of the laser welding a laser beam of a low output is applied and, thereafter, a laser beam of a high output is applied.

Page 4, paragraph starting at line 19, has been amended as indicated below:

Further, in the process for producing the lead-acid battery according to the present invention, ~~it is characterized in that~~ the laser welding is of a pulsed type.

Page 4, paragraph starting at line 22, has been amended as indicated below:

Further, in the process for producing the lead-acid battery according to the present invention, ~~it is characterized in that~~ the lap density of beads in the laser welding of the pulsed type is in a range of 6 ~ 12 points per mm.

Page 4, paragraph starting at line 26, has been amended as indicated below:

Further, it is an object of the present invention to provide a process for the laser welding of the terminal portions of the lead acid battery for preventing a laser beam from intercepting by fumes generated at the time of application thereof in the laser welding in the process for producing the above-mentioned lead-acid battery, to make it possible to carry out the welding at a high efficiency and stably and sufficiently, ~~and it is characterized in such~~ that when the laser-welding is carried out by applying the laser to terminal portions to be welded of the lead-acid battery, ~~there is used such~~ a process for laser-welding of the terminal portions is used such that the terminal portions are surrounded by a lower cylindrical end portion of a cylindrical shield, and, in this state, fumes generated at the time of the laser-welding are sucked to be exhausted to the outside of the cylindrical shield through an exhaust port in the cylindrical shield.

Page 5, paragraph starting at line 16, has been amended as indicated below:

Further, it is an object of the present invention to provide a process for the laser welding of the terminal portions which is capable of carrying out the welding by application of the laser beam

accurately and at a good efficiency when the above-mentioned process for laser welding is used in the above-mentioned process for producing the lead-acid battery, and ~~it is characterized in that~~ a discharge opening is provided in the cylindrical shield, and oxygen or air is supplied through the discharge opening to the portions to be welded.

Page 5, paragraph starting at line 25, has been amended as indicated below:

Further, it is an object of the present invention to provide a process for laser welding for carrying out the laser welding more accurately and at a better efficiency when the above-mentioned process for laser welding is used in the above-mentioned process for producing the lead-acid battery, and ~~it is characterized in that~~ a shroud ring having the plural of communication openings made circumferentially in its peripheral wall is installed in the cylindrical shield with an annular space left between the shroud ring and the inner peripheral wall surface of the cylindrical shield so that fumes generated in the shroud ring may be sucked to be exhausted out of the cylindrical shield through the communication holes of the shroud ring, the annular space surrounding thereof and the exhaust port, together with a shielding fluid flowed through the discharge opening into the cylindrical shield.

Page 6, paragraph starting at line 13, has been amended as indicated below:

Further, the present invention, which is capable of carrying out the laser welding at a better efficiency while removing the fumes at a good efficiency by the laser welding when the above-mentioned laser welding is used in the above-mentioned process for producing the lead-acid battery,

and ~~it is characterized in that~~ the plural communication bores made at regular intervals in the shroud ring are formed into those which are open in a circumferentially tangent direction of the ring, whereby an eddy flow is occurred to the fumes generated inside the shroud ring and is sucked to be exhausted.

Page 9, paragraph starting at line 13, has been amended as indicated below:

More specifically, the assembled lead-acid battery A comprises a mono-block type lead-acid battery, for example, comprising six cells. In the drawings, reference character a designates a molded battery container made of a synthetic resin such as polypropylene, and reference character b designates a molded lid for the battery container which is abutted against and air-tightly bonded to the upper surface of the container a, which has an upper flat surface and which is provided with a lead bushing 1 integrally cast thereinto by a casting process using a synthetic resin such as polypropylene as a raw material. The lead bushing 1 is ~~preferable to be~~ preferably made using, preferably, lead alloys such as Pb-Ca-Sn, etc. as a material. According to the present invention, the lead bushing 1 is so cast that a projected height h from the upper surface of the lid b to the upper end surface thereof as to be such a very low height that is 15 mm or less, preferably, 10 mm or less, e.g., 4 mm in the illustrated embodiment.

Page 12, paragraph starting at line 3, has been amended as indicated below:

The nozzle 4 is connected to a predetermined laser-generating source ~~not shown~~ through an optical fiber 4b. A type of a laser is for example, a YAG laser by which the laser welding according to the present invention is carried out. A method of the laser welding may be either a continuous welding one or a pulsed welding one, but, in a case where the depth of weld (penetration) of lead or a lead alloy is required to be made deep, the pulsed welding method is preferable. The laser welding according to the present invention is carried out by applying a laser beam of an high output, for example, 6 ~ 8 Joules enough to weld the lead or lead alloy, to and along the mutually abutted or adjacent circular portions 8 of the outer peripheral surface of the pole 2 and the outer peripheral surface of the lead bushing 1 or their vicinities, and moving it at least one round while welding the portions 8 together, so that welding between the pole 2 and lead bushing 1 is welded together to form a laser-welded terminal portion. It is sufficient if the depth of weld or penetration of the laser-welded portion is at least about 2.5 mm. The present inventors have found that, according to this laser-welding, even if the height of the lead bushing 1 from the upper surface of the lid b is only 4 mm, a stable and good welding the pole 2 and the bushing 1 together can be achieved without occurrence in the thermal deformation of the lid b. Accordingly, in respect of the lead-acid battery thus produced according to the present invention, the lead bushing terminal protruding from the upper surface of the lid b is as only low as 4 mm, so that there is brought about such an effect that the height space above the terminal can be lowered remarkably, as compared with 8 ~ 10 mm or more conventionally required.



Page 19, paragraph starting at line 22, has been amended as indicated below:

Further, according to the present invention, in order to weld the lead bushing 1 and the tab terminal member 10 therearound to each other, the laser welding of ~~[[the]]~~ both of them is carried out by applying a laser beam 5a from the laser nozzle 5 to mutually ~~abutted~~ abutting annular portions 13 of the lead bushing 1 and the tab terminal member 10 through the glass shield 5. In this case, as for a method of laser-welding, either a continuous welding type one or a pulsed welding type one may be adapted and the laser beam thereof is applied or irradiated, in the same manner as explained in the previous embodiment. Preferably, by the pulsed welding, a laser beam of a low output as low as 0.8 ~ 1.5 Joules/pulse is first applied to the surface of the lead terminal member 10 to expose lead inside the lead terminal member 10 to the outer surface thereof, and then, a laser beam of a high output as high as 6 ~ 8 Joules/pulse and in a rang of 6 points ~ 12 points of the lap number of beads/mm is applied, thereby the laser welding of the projection 1a of the lead bushing 1 and the lead tab terminal member 10 therearound to each other is carried out, so that production of a lead-acid battery is completed.